

CLAIMS

1. A method of removing a conductive material from an edge region of a workpiece comprising the steps:
supplying an etch solution to create an etchant bead at a contoured opening of an edge removal device;
contacting the edge region of the workpiece with the etchant bead;
establishing relative motion between the workpiece and the edge removal device to remove the conductive material from the edge region of the workpiece.
2. The method of claim 1, wherein the step of supplying the etch solution includes the step of maintaining the etchant bead at the opening of the edge removal device.
3. The method of claim 1, wherein the edge removal device includes a cavity having the opening and the step of contacting the etchant bead includes inserting the edge region of the workpiece into the cavity.
4. The method of claim 3, wherein the edge region includes a top area, a bottom area, and a side area of the workpiece and the step of contacting the etchant bead includes contacting the etch solution with the top area, the bottom area, and the side area of the workpiece.
5. The method of claim 4, wherein the cavity further includes an open area and the step of contacting the etchant bead includes contacting a pool of the etch solution with the bottom area and the side area of the workpiece.
6. The method of claim 4, wherein the cavity further includes an open area and the step of contacting the etchant bead includes contacting a pool of the etch solution with the top area and the side area of the workpiece.
7. The method of claim 3, wherein the cavity includes a spongy material.
8. The method of claim 7, wherein the step of contacting the etchant bead includes contacting the edge region of the workpiece with the spongy material.

9. The method of claim 3, wherein the cavity includes a large opening having supplementary material placed in the opening and the step of creating an etchant bead includes forming the etchant bead with the supplementary material.
10. The method of claim 8, wherein the supplementary material comprises soft bristles placed on an upper cavity wall and a lower cavity wall.
11. The method of claim 3, wherein the cavity includes a draw-off port and the step of supplying the etch solution includes flowing the etch solution out through the draw-off port.
12. The method of claim 3, wherein the cavity includes an upper bleed opening coupled to the cavity and further comprises the step of bleeding bubbles from a pool of the etch solution contained in the upper bleed opening.
13. The method of claim 4, wherein the opening includes a V-shaped opening and the step of maintaining the etchant bead includes maintaining an etchant bead at the V-shaped opening.
14. The method of claim 13, wherein the edge removal device includes an edge removal ring having the V-shaped opening and the step of establishing relative motion includes rotating the edge removal ring.
15. The method of claim 14 further comprising the step of varying the V-shaped opening to control an amount of the etchant bead in contact with the top area, the bottom area, and the side area of the workpiece.
16. The method of claim 14, wherein the V-shaped opening includes a spongy material.
17. The method of claim 16, wherein the step of contacting the etchant bead includes contacting the edge region of the workpiece with the spongy material.
18. The method of claim 14 further comprising the step of wiping the V-shaped opening with a wiping device.

19. An integrated circuit manufactured including the steps of claim 1.
20. An integrated circuit manufactured including the steps of claim 14.
21. An apparatus for removing a conductive material from an edge region of a workpiece using an etch solution, comprising:
 - a feed line configured to receive the etch solution;
 - a cavity having a contoured opening coupled to the feed line and configured to receive the etch solution and form an etchant bead at the cavity opening; and
 - a workpiece carrier configured to contact the edge region of the workpiece with the etchant bead to remove the conductive material.
22. The apparatus of claim 21, wherein the workpiece carrier is configured to rotate the workpiece.
23. The apparatus of claim 21, wherein the contoured opening of the cavity includes an edge contour substantially similar to the workpiece.
24. The apparatus of claim 21, wherein the workpiece carrier is configured to translate the workpiece with respect to the cavity.
25. The apparatus of claim 21, wherein:
 - the cavity includes an open area;
 - the edge region of the workpiece includes a top surface area, a bottom surface area, and a side area; and
 - the workpiece carrier is configured to contact a surface area and the side area of the workpiece with the etchant bead.
26. The apparatus of claim 21, wherein the cavity includes spongy material.
27. The apparatus of claim 21, wherein the cavity includes a large contoured opening having supplementary material in the large contoured opening.

28. The apparatus of claim 21 further comprising a bleed opening coupled to the feed line and the cavity configured to form a pool of the etch solution and bleed bubbles from the etch solution through the bleed opening.
29. The apparatus of claim 21 further comprising a wheel having a V-shaped circumferential wall fluidly coupled to the feed line and the cavity, the wheel configured to receive the etch solution and form an etchant bead at the V-shaped circumferential wall.
30. The apparatus of claim 29, wherein the V-shaped circumferential wall is configured to rotate.
31. The apparatus of claim 29, wherein the V-shaped circumferential wall is configurable to control an amount of the etchant bead in contact with the edge region of the workpiece.
32. The apparatus of claim 29 further comprising a wiping device coupled to the V-shaped circumferential wall configured to remove residual etch solution remaining in the V-shaped circumferential wall.